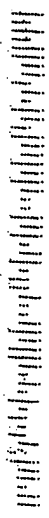


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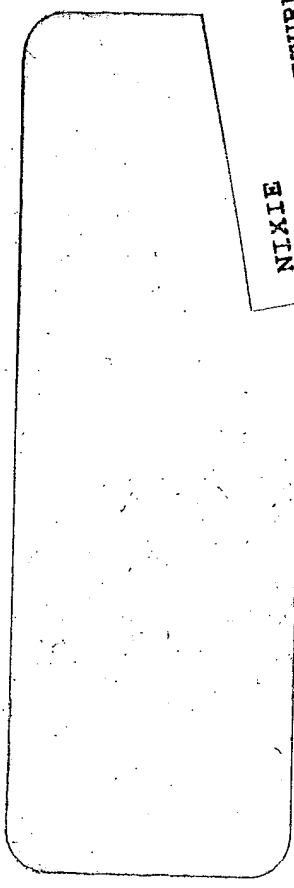
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/484,051	01/18/2000	Chan-hoon Park	SEC.0689	9194
7590 07/06/2005				
Jones Volentine LLP Suite 150 12200 Sunrise Valley Drive Reston, VA 20191		EXAMINER CIRIC, LJILJANA V		
		ART UNIT 3753		PAPER NUMBER

DATE MAILED: 07/06/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

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42

Office Action Summary

Application No.

09/484,051

Applicant(s)

PARK, CHAN-HOON

Examiner

Ljiljana (Lil) V. Ciric

Art Unit

3753

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 Dec 2001, 14 Mar 2002, and 3 Sep 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1, 7, 8, 13-15, 19, 20 and 24 is/are pending in the application.
- 4a) Of the above claim(s) none is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 7, 8, 13-15, 19, 20 and 24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 January 2000 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

Notice of References Cited	Application/Control No. 09/484,051	Applicant(s)/Patent Under Reexamination PARK, CHAN-HOON	
	Examiner Ljiljana (Lil) V. Ciric <i>ARC</i>	Art Unit 3753	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-5,034,688	07-1991	Moulene et al.	165/80.4
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	Masao, Tsuji, "Substrate Heating Device", PTO 05-4319 HAMT, English translation by Schreiber Translations, Inc. of Japanese Patent Document No. 06-349722.
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

DETAILED ACTION

Response to Amendment

1. This Office action is in response to the replies filed on December 11, 2001, March 14, 2002, and September 3, 2002.
2. Claims 1, 7, 8, 13 through 15, 19, 20, and 24 remain in the application.
3. As previously indicated via the petition decision mailed on October 4, 2002, applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn.

Response to Arguments

4. Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection.

Priority

5. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Drawings

6. New corrected drawings in compliance with 37 CFR 1.121(d) are required in this application because the drawings filed on January 18, 2000 have already been objected to by the Draftsperson via the Notice of Draftsperson's Patent Drawing Review previously mailed as an attachment to Paper No. 5. Applicant is advised to employ the services of a competent patent draftsman outside the Office, as the U.S. Patent and Trademark Office no longer prepares new drawings. The corrected drawings are required in reply to the Office action to avoid abandonment of the application. The requirement for corrected drawings will *not* be held in abeyance.

Claim Rejections - 35 USC § 112

Art Unit: 3753

7. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

8. Claim 24 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. More specifically, claim 24 recites the limitations that "the solid heat transfer medium is heated substantially only by radiant heat derived from the vapor of the fluid heat transfer medium". While this is not new matter since essentially the same set of limitations were cited in claim 6 as originally filed, the originally filed disclosure, including the originally filed specification, fail to provide any written description in support of this set of limitations. The originally filed disclosure fails to provide any explanation of how these method limitations are effected or which particular structure of the corresponding apparatus, for example, ensures that only radiant heat derived from the vapor of the fluid heat transfer medium heats the solid heat transfer medium.

9. Claim 24 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. More particularly, claim 24 recites the limitations that "the solid heat transfer medium is heated substantially only by radiant heat derived from the vapor of the fluid heat transfer medium". Since the originally filed disclosure fails to provide any explanation of how these method limitations are effected or which particular structure of the corresponding apparatus, for example, ensures that only radiant heat derived from the vapor of the fluid heat transfer medium heats the solid heat transfer medium, one skilled in the art at the time of invention would not know how to exclude any convective and conductive heat transfer from occurring between the fluid heat transfer medium and

Art Unit: 3753

the solid heat transfer medium in order to make and use the invention according to claim 24 without undue experimentation.

10. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

11. Claims 8, 13 through 15, 19, 20, and 24 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

There is insufficient antecedent basis in the claims for the limitations “an enclosed space” [claim 8, line 4], “cavities of said refractory porous body” [claim 13, lines 3-4], and “at least one of respective surfaces of said heat source and said solid heat transfer medium which face toward one another” [claim 15, lines 2-3].

With regard to base claim 8 as written, it is not clear whether the enclosed space cited in line 4 of the claim and the singular groove cited in lines 12 and 13 of the claim refer to the same element or not, thus rendering indefinite the metes and bounds of protection sought by the claims. If both of these terms refer to the same element, then only one term should be used throughout for improved consistency and clarity. If these refer to different elements, then the structural relationship between the enclosed space and the singular groove should be more clearly specified in the claims.

Claim 24 as written appears to be self-contradictory, and thus indefinite with regard to the scope of protection sought thereby. More particularly, claim 24 first recites “so that the wafer is heated with the heat which has been transferred *from the vapor of the fluid transfer medium*, and from the heat source *by conduction, to the solid heat transfer medium*”, then goes on to exclude heat transfer by conduction by reciting “wherein *the solid heat transfer medium is heated substantially only by radiant heat* derived from the vapor of the fluid heat transfer medium.”

Art Unit: 3753

Claims 8, 13 through 15, 19, and 20 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are: the one(s) between the enclosed space and the singular groove as recited in base claim 8.

The above is an indicative, but not necessarily an exhaustive, list of 35 U.S.C. 112, second paragraph, problems. Applicant is therefore advised to carefully review all of the claims for additional problems. Correction is required of all of the 35 U.S.C. 112, second paragraph problems, whether or not these were particularly pointed out above.

Claim Rejections - 35 USC § 102

12. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

13. As best can be understood in view of the indefiniteness of claims 8 and 19, claims 1, 7, 8, and 19 are rejected under 35 U.S.C. 102(b) as being anticipated by Shinya et al. (previously of record).

With regard to claims 1 and 7, Shinya et al. [especially Figure 1] discloses a method of heating a substrate or wafer 10 essentially as claimed, including, for example: generating heat using a heat source or heater 5 to be supplied to the wafer or substrate 10; transferring the heat to a liquid component 2 of a fluid heat transfer medium in an amount sufficient to evaporate the liquid 2 and produce a vapor 2a; transferring heat from the vapor 2a of the fluid medium to a solid heat transfer medium 1 wherein vapor 2a is condensed back into a liquid phase 2; supporting the wafer or substrate 10 on the solid heat transfer medium 1 so that the wafer or substrate 10 is heated with the heat which has been transferred from the vapor 2a of the fluid heat transfer medium to the solid heat transfer medium 1; wherein the step of

Art Unit: 3753

transferring heat from the vapor 2a of the fluid heat transfer medium to the solid heat transfer medium 1 comprises directing the fluid heat transfer medium toward the solid heat transfer medium using capillary action (i.e., surface tension, which is inherently a factor in evaporation) at least as broadly interpreted as required; and wherein the step of transferring heat from the vapor 2a of the fluid heat transfer medium to the solid heat transfer medium 1 further comprises circulating the fluid heat transfer medium along at least one closed loop path located adjacent the solid heat transfer medium 1 with the evaporation and condensation occurring within the confines of the solid heat transfer medium being inherently a closed circulatory loop for the fluid heat transfer medium. At least a portion of the heat from the heat source or heater 5 is transferred from the heat source or heater 5 to the solid heat transfer medium 1 via conduction at the interface between the two elements.

With regard to claims 8 and 19, Shinya et al. [especially Figure 2] discloses a wafer or substrate heating apparatus essentially as claimed, including, for example: a heat source or heater 5; a solid heat transfer medium 1 on which the wafer or substrate 10 is to be supported; a fluid heat transfer medium contained in an enclosed space located between the solid heat transfer medium 1 and the heat source or heater 5; the heat source comprising a heater block having an upper surface facing towards a lower surface of the solid heat transfer medium 1, with at least one of the upper surface of the heater block or heater 5 and the lower surface of the solid heat transfer medium 1 defining a singular groove in a closed loop shape in which the fluid heating medium 2 is contained, the enclosed space being delimited by the solid heat transfer medium 1 such that the vapor of the fluid heat transfer medium 2 may contact the solid heat transfer medium 1 directly. Tubular temperature sensor 4 is disposed in the singular groove.

The reference thus reads on the claims.

Claim Rejections - 35 USC § 103

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

Art Unit: 3753

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

15. Alternately for claims 8 and 19, and as best can be understood in view of the indefiniteness of the claims, claims 8, 19, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moulene et al.

Moulene et al. [especially Figures 6 and 8] discloses a wafer heating apparatus essentially as claimed, including, for example: resistive heat source 16 and layers 8a and 8b which could be considered as forming a heater block; a solid heat transfer medium 1b on which a wafer or substrate 2 is to be supported; and, a singular groove defined by the upper surface or layer 8a of the heater block in which tube or tubular body 17 is disposed. While Moulene et al. does not show the enclosed space including the fluid heat transfer medium and presumably the singular groove as being disposed between the solid heat transfer medium 1b and the heat source 16, but instead shows the heat source 16 as being disposed between the enclosed space and the solid heat transfer medium, it is hereby noted that merely shifting the relative position of the parts of an apparatus or the rearrangement of parts, absent a corresponding modification of the operation of the apparatus or unexpected results associated therewith, is generally not considered inventive. See *In re Japikse*, 181 F.2d 1019, 86 USPQ 70 (CCPA 1950). Also, while Moulene et al. does not disclose the tubular body or tube 17 as having internal fins, Official Notice is hereby taken that it is notoriously well-known in the art of heat exchange to place internal fins inside of tubular bodies or tubes carrying a heat transfer fluid.

Thus, it would have been obvious to one skilled in the art at the time of invention to modify the wafer heating apparatus of Moulene et al. by reversing or switching the relative locations of the heat source 16 and the enclosed space in which the fluid heat transfer medium is located such that the enclosed space is sandwiched between the solid heat transfer medium and the heat source in order to make it less likely for overheating to occur of the overheat the solid heat transfer medium and of any wafer disposed

Art Unit: 3753

thereon. It would have been similarly obvious to one skilled in the art at the time of invention to modify the wafer heating apparatus of Moulene et al. by adding internal fins to the tubular body or tube 17 in order to increase the heat transfer rate effected by the heat transfer fluid flowing therethrough.

Allowable Subject Matter

16. As best can be understood in view of the indefiniteness of the claims, claims 13 through 15 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action without any significant broadening and to include all of the limitations of the base claim and any intervening claims.

17. The non-application of art against claim 24 should not be construed as an indication that the claim contains allowable subject matter but rather that the patentability of the claim cannot be determined at this time due to indefiniteness and/or other problems under 35 U.S.C. 112, first and second paragraphs.

Conclusion

18. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

19. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ljiljana (Lil) V. Ciric whose telephone number is 571-272-4909. The examiner can normally be reached on Mondays through Fridays from 10:00 a.m. to 6:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gene Mancene, can be reached at 571-272-4930.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair->

Application/Control Number: 09/484,051

Page 9

Art Unit: 3753

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Ljiljana (Lil) V. Ciric
Primary Examiner
Art Unit 3753

PTO 05-4319 HAMT

Japanese Patent
Document No. 06-349722

SUBSTRATE HEATING DEVICE

[基板加熱装置]

Tsuji Masao

UNITED STATES PATENT AND TRADEMARK OFFICE

Washington, D.C.

June 2005

Translated by: Schreiber Translations, Inc.

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SUBSTRATE HEATING DEVICE

(51) [International Patent Classification, 5th Edition]

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G11B 7/26 521 7215-5D

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21/68 N

[FI]

H01L 21/30 361 H 7352-42-

[Number of Claims]

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[Request for Examination]

Not requested

(21) [Application Number]

Japan Patent Application Hei 5- 166231

(22) [Application Date]

1993 June 10

(71) [Applicant]

[Identification Number]

207551

[Name]

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Sugitani Ben

(57) [Abstract]

[Objective]

As without decreasing, it tries responsiveness to be able to heat substrate to uniform, heater shape evades fact that constraint it is done in shape of substrate loading plate.

[Constitution]

As substrate W mount or proximity fluid holding chamber 9 is formed inside substrate loading plate 2 which is mounted, water L is accommodated inside fluid holding chamber 9, to form steam space S which steam residence is done, at same time, to install mica heater 10 in lower face of substrate loading plate 2, water L evaporating with heating mica heater 10, residence doing in steam space S, substrate W is heated with heat release of heat of condensation which accompanies the condensing of steam.

[Claim(s)]

[Claim 1]

With relative ascent and descent of substrate the aforementioned substrate mount or proximity in substrate heating device which has substrate loading plate which is mounted,

Inside the aforementioned substrate loading plate, fluid holding chamber which accommodates the working fluid which evaporates with certain temperature is formed, at same time as, steam space which steam residence is done is formed in fluid holding chamber, substrate heating device. which designates that heating means which heats working fluid inside the aforementioned fluid holding chamber is installed in the aforementioned substrate loading plate as feature

[Description of the Invention]

[0001]

[Field of Industrial Application]

this invention in order to heat substrate or other group sheet for glass substrate, optical disc for glass substrate, liquid crystal display device for semiconductor wafer, photo mask, mount or proximity being installed substrate by substrate loading plate and substrate loading plate which are mounted by relative ascent and descent of substrate, through substrate loading plate, regards substrate heating device which has heating means which is a heat source in order to heat substrate.

[0002]

[Prior Art]

With conventional substrate heating device, seed heater is casted inside substrate loading plate which formed with metallic material where aluminum and copper or other thermal conductivity are high when, it has produced substrate loading plate and mica heater or other planar heat emitting body etc of same size such as are stuck to the lower face of substrate loading plate with.

[0003]

[Problems to be Solved by the Invention]

With substrate heating device of this kind, when for example substrate is heated to 100 deg C, as for temperature distribution in substrate surface uniformity of extent which is settled in width under 1 deg C is required.

[0004]

But, with conventional substrate heating device, any heater, there is a variation of temperature in the heat-emitting part of heater itself, there was a deficiency where uniformity of temperature distribution where variation is easy to appear that way on substrate loading aspect of the substrate loading plate, surface of substrate in decreases.

[0005]

Then, in order to raise uniformity, making substrate loading plate thick, it makes distance of heater and substrate loading

aspect long, it can think that it eases fact that variation of temperature of heat-emitting part appears on the substrate loading aspect, but in that case, from heater time being required for conducted heat to substrate loading aspect, responsiveness to decrease, at the same time, device had deficiency which scale-up is done from circumstances which make distance of the aforementioned heater and substrate loading aspect long.

[0006]

In addition, in combination with shape of heater to shape of substrate loading plate, you must design, there was a deficiency where in order to receive constraint in regard to design production cost becomes expensive.

[0007]

this invention, considering to situation a this way, being something which it is possible, as responsiveness without decreasing, it tries to be able to heat substrate to uniform, heater shape designates that to be able to evade thing which constraint is done it tries as objective in shape of substrate loading plate.

[0008]

[Means to Solve the Problems]

As this invention in order to achieve objective an above-mentioned way, inside substrate loading plate, forms fluid holding chamber which accommodates working fluid which evaporates with certain temperature with relative ascent and descent of the substrate mount or proximity in substrate heating device which has substrate loading plate which is mounted, at same time, forms steam space which steam residence is done in fluid holding chamber, Installing heating means which heats working fluid inside the aforementioned fluid holding chamber in the aforementioned substrate loading plate, configuration it does.

[0009]

[Working Principle]

When it evaporates, steam inside steam space, residence doing the working fluid inside fluid holding chamber according to

configuration of substrate heating device of the this invention, with heating means mount or proximity it contacts ceiling surface of fluid holding chamber which is suitable to lower of substrate which is mounted in substrate loading plate, over there liquefaction it does with cooling, temperature of substrate loading plate can rise with heat release of heat of condensation, can heat substrate.

With site where temperature is low at time of this, among ceiling surface of fluid holding chamber, in comparison with other portion, reaction of liquefaction of steam of working fluid it happens actively in comparison with other portion, in order for temperature distribution of substrate loading plate to become uniform, it can operate, it can heat to uniform in relation to the substrate.

[0010]

[Working Example(s)]

Next, Working Example of this invention is explained based on the drawing in detail.

[0011]

As for Figure 1, as for entirety longitudinal cross-sectional view, Figure 2 which shows first Working Example of the substrate heating device which relates to this invention with partially cutaway oblique diagram of principal part, inside processing chamber 1 it can provide substrate loading plate 2 of transverse section shape round with aluminum, through hole 3... is formed to substrate loading plate 2, through hole 3... it can provide wafer support pin 4 respectively in able to raise and able to lower, furthermore, air cylinder 6 linkage coupling is done in support member 5 which keeps wafer support pin 4... in integral, In order ascent and descent to do wafer support pin 4... with extension and retraction of the air cylinder 6, configuration it is done, it is designed in such a way that with state which rose substrate W it carries & it carries out, mounting substrate W on substrate loading plate 2 and, wafer support pin 4... by falling, it can support the wafer support pin 4... with substrate transport robot (not shown)..

[0012]

As recess 7 is formed to specified site of top of substrate loading plate 2, into recess 7 each one, ceramic ball 8 of large

diameter is inserted a little from depth of recess 7, mounts with state which maintaining the fine gap at substrate loading aspect of substrate loading plate 2, proximity does substrate W, in order to be able to heat to uniform with radiant heat from substrate loading aspect, configuration is done.

[0013]

As fluid holding chamber 9 is formed inside substrate loading plate 2, inside fluid holding chamber 9, water L as one example of working fluid being predetermined vacuum state, it is enclosed, at the same time, upper part space of fluid holding chamber 9 is formed steam by steam space S which residence is done, furthermore, mica heater 10 as heating means is installed in lower face of substrate loading plate 2.

[0014]

Water L evaporating with configuration above, with heating the mica heater 10, steam occurrence almost in simultaneous steam arriving in the ceiling surface of fluid holding chamber 9 steam by residence doing inside steam space S, it heats substrate loading aspect of substrate loading plate 2 quickly, on substrate loading plate 2 proximity it has reached point where substrate W which is mounted is heated.

If at time of this, there is a portion where temperature is low in substrate loading aspect, condensing happens intensively actively with the ceiling surface site of fluid holding chamber 9 which is close to that can heat intensively with heat release of heat of condensation, can heat to uniform substrate loading aspect of the substrate loading plate 2 over entire surface.

[0015]

As for Figure 3, as for entirety longitudinal cross-sectional view, Figure 4 which shows second Working Example of substrate heating device which relates to this invention with oblique view of principal part, as for first Working Example and different place as follows is.

namely, substrate loading plate 2 and fluid holding chamber 9, configuration are done in convex shape of downward in longitudinal cross section shape, mica heater 10 is installed in lower face where surface area of substrate loading plate 2 is small.

[0016]

In addition, floor of portion where surface area of upward side of fluid holding chamber 9 is large about center side configuration is done in inclined surface which becomes low, in order to be easy to reset water L which condensing is done configuration is done.

Other configuration attaches and, being same as first Working Example, the same figure number abbreviates explanation due to especially.

[0017]

It has possessed benefit which can use those where surface area is small according to this second Working Example, as mica heater 10.

[0018]

As for Figure 5, with oblique view of principal part which shows the third Working Example of substrate heating device which relates to this invention, planar view shape of substrate loading plate 2 configuration is done in square, when angular type substrate is heated, in order to be able to apply, configuration is done.

It is not necessary to designate mica heater 10 as square even with the this Working Example.

Other configuration attaches and being same as second Working Example, the same figure number abbreviates explanation due to especially.

[0019]

With above-mentioned Working Example, in order substrate W maintaining the fine gap at substrate loading aspect of substrate loading plate 2, in order with state which proximity it does to mount configuration it has done, but without providing ceramic ball 8, mounting substrate W directly in substrate loading plate 2, to support with ceramic ball 8, configuration it is good doing.

[0020]

In addition, with the above-mentioned Working Example, in order

in order to mount substrate W in substrate loading plate 2, ascent and descent to do wafer support pin 4, the configuration it has done, but ascent lowering substrate loading plate 2, in order to mount substrate W, configuration it is good doing.

[0021]

In addition, it is used, as working fluid, as working fluid for example heat pipe the water and ammonia, freon 11, freon 113, pentane, acetone, methanol, fulltech PP2, ethanol, heptane, fulltech PP9, sermex, be able to use mercury etc, adjusting to temperature which as needed, it tries to heat as you adopt, if boiling point of working fluid is set to desired temperature by vacuum or pressurizing inside fluid holding chamber, it is good.

[0022]

[Effects of the Invention]

As above explained, according to substrate heating device of this invention, because the substrate is heated with condensing which accompanies cooling steam of working fluid making use of heat of condensation, there being a non-uniform in temperature substrate loading aspect, in substrate which is mounted in namely, substrate loading plate, be able to heat site where temperature is low naturally intensively, furthermore, Movement of steam being quite high speed, when thickness of the substrate loading plate is enlarged, comparing, responsiveness without decreasing, be able to heat substrate to uniform, at same time, it reached point where device can be designated as miniature, light weight.

[0023]

Furthermore, as heating means, if only it does to evaporate working fluid inside fluid holding chamber, being good, there are not times when what constraint it is done in shape of substrate loading plate configuration is done heating means as shape of heater which, design easy and being able to produce in inexpensive, it is a economical.

[Brief Explanation of the Drawing(s)]

[Figure 1]

It is a entirety longitudinal cross-sectional view which shows first Working Example of substrate heating device which relates

to the this invention.

[Figure 2]

It is a partially cutaway oblique diagram of principal part.

[Figure 3]

It is a entirety longitudinal cross-sectional view which shows second Working Example of substrate heating device which relates to the this invention.

[Figure 4]

It is a oblique view of principal part.

[Figure 5]

It is a oblique view of principal part which shows third Working Example of substrate heating device which relates to this invention.

[Explanation of Symbols in Drawings]

	10
mica heater as heating means	
	2
substrate loading plate	
	9
fluid holding chamber	
L	
Water as one example of working fluid	
S	
steam space	
W	
substrate	

[Figure 1]

[Figure 2]

[Figure 3]

[Figure 4]

[Figure 5]

NEW CENTRAL FAX NUMBER

Effective July 15, 2005

On July 15, 2005, the Central FAX Number will change to **571-273-8300**. This new Central FAX Number is the result of relocating the Central FAX server to the Office's Alexandria, Virginia campus.

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